IN THE CLAIMS:

1. A method for determining the thermal expansion coefficient of a substance comprising:

determining at each of two or more temperatures the absolute position of more than one resonant interference peaks of a Fabry-Perot etalon whose optical path is defined by said substance and calculating said coefficient from observed difference(s) in wavelength or frequency of said positions at said two or more temperatures.

2. A method of claim 1, where frequency positions are measured.

3. A method of claim 1, wherein wavelength positions are measured.

4. A method of claim 1, wherein said Fabry-Perot etalon consists essentially of a solid sample of said substance having highly flat end surfaces.

5. A method of claim 1, wherein said Fabry-Perot etalon comprises an optical path consisting essentially of said substance and at the ends thereof highly flat plates of a different material.

6. A method of claim 1, wherein the change in length (ΔL) of said material at two different temperatures is calculated from the measured differences ($\Delta \nu$) in respective frequency peak positions by the equation:

$$\Delta \nu = \frac{-\nu}{L} \Delta L , \qquad (4)$$

where L is the Fabry-Perot gap at the first temperature and ν is the frequency position of the respective peak at said temperature.

7. A method of claim 1, wherein the frequency peak positions are in the range of 1300 - 1700 nm.

8. A method of claim 1, wherein the end surfaces of the etalon has $\lambda/20$ flatness or better and <0.5 arc second parallelism or better.

9. A method of claim 1, wherein the number of said peak positions measured is ten or more.

10. A method of claim 1, wherein the finesse of the etalon is 1 - 1000.